

## A FLUID DISPENSER PUMP

The present invention relates to a fluid dispenser pump and to a fluid dispenser device including such a pump.

5 Pumps are well known for dispensing powders or fluids, in particular in the fields of pharmacy, perfumery, or cosmetics. Such pumps often include a pump body that contains a pump chamber in which a piston slides in leaktight manner, so as to dispense, in metered  
10 manner, a substance contained in the pump chamber. When the pump is a metering pump, the pump chamber generally includes an inlet valve and an outlet valve, which, when they are both closed, define the volume of the dose to be dispensed. Sealing the outlet valve in the closed  
15 position serves firstly to avoid leakage during actuation, but also to avoid any contamination of the substance contained in the pump chamber in the rest position. Particularly in the field of pharmacy in which a precise and reproducible dose is often required, any  
20 risk of leakage, and thus reduction in dose, is not desirable. Consequently, the sealing at the outlet valve must be substantial. However, when the outlet valve is in the closed position, substantial sealing should not prevent said valve from functioning properly, e.g. by  
25 blocking it in the closed position, thereby preventing the pump from functioning properly, and thus preventing a correct dose from being dispensed.

An object of the present invention is to provide a fluid dispenser pump that satisfies the above-mentioned  
30 requirements in optimum manner, without reproducing the drawbacks of the prior-art pumps.

More particularly, an object of the present invention is to provide a fluid dispenser pump that provides perfect sealing when the outlet valve of the  
35 pump chamber is in the closed position.

Another object of the present invention is to provide a fluid dispenser pump that functions in safe and

reliable manner, and that guarantees precise and reproducible dispensing of a dose of fluid each time the pump is actuated.

Another object of the present invention is to  
5 provide a fluid dispenser pump that is simple and inexpensive to manufacture and to assemble.

The present invention thus provides a fluid dispenser pump comprising a pump body, a pump chamber provided with an inlet valve and with an outlet valve, and  
10 a piston sliding in said pump body so as to dispense the fluid contained in the pump chamber, said outlet valve comprising a valve element co-operating with a valve seat, said outlet valve further comprising deformable sealing means provided between said valve seat and said  
15 valve element, said sealing means being elastically deformed when said outlet valve is in the closed position, so as to improve sealing.

Advantageously, said piston is secured to an actuator rod, said actuator rod being hollow and defining  
20 an expulsion channel for the fluid, said valve seat being formed in said expulsion channel.

While the pump is being actuated, the outlet valve is advantageously, urged towards its closed position by a spring, said valve being opened by the pressure of the  
25 fluid contained in the pump chamber.

In a first embodiment of the invention, said deformable sealing means are formed on the valve element.

In a second embodiment of the invention, said deformable sealing means are formed on the valve seat.

30 In a first embodiment of the present invention, said deformable sealing means comprise at least one deformable annular lip.

Advantageously, said annular lip is flexible and co-operates with a frustoconical surface when the valve is  
35 in the closed position.

Advantageously, said annular lip is made by overmolding.

The valve seat advantageously includes a flexible annular lip co-operating with a frustoconical valve element, said valve element being substantially rigid.

Advantageously, the valve seat is made out of two materials, said annular lip being made out of a material that is softer than the remainder of the valve seat.

In a second embodiment of the present invention, said deformable sealing means comprise a deformable O-ring.

Advantageously, said O-ring co-operates with a frustoconical surface when the valve is in the closed position.

Advantageously, said O-ring is secured by interfitting, snap-fastening, or overmolding.

Advantageously, the valve element is substantially rigid and includes a deformable O-ring co-operating with a frustoconical valve seat, said valve seat being substantially rigid.

The present invention also provides a fluid dispenser device including a pump as described above.

Other characteristics and advantages of the present invention appear more clearly from the following detailed description of two embodiments thereof, given by way of non-limiting example, and with reference to the accompanying drawings, and in which:

- Figure 1 is a diagrammatic section view of a pump constituting a first embodiment of the present invention; and

- Figure 2 is a view similar to that of Figure 1 showing a second embodiment of the present invention.

The figures show an example of a pump, but naturally the present invention applies to any type of pump, with structures that are different from those shown in the drawings.

With reference to Figure 1, the pump includes a pump body 10 in which there slides a piston 50 secured to an actuator rod 5. The actuator rod 5 is advantageously

hollow and defines an expulsion channel 4 for the fluid. The pump body 10 contains a pump chamber 20 that is defined between an inlet valve 30 and an outlet valve 40. In the example shown, the outlet valve 40 and the inlet valve 30 includes a common valve element 41. When the inlet valve 30 is in the closed position, the valve element is urged against an inlet valve seat 32 that is advantageously secured to the pump body 10, and when the outlet valve 40 is in the closed position 40, the valve element is urged against an outlet valve seat 42 that is advantageously secured to the actuator rod 5, and preferably defined at the expulsion channel 4. Naturally, the present invention also applies to pumps in which the inlet and outlet valve elements 30, 40 are different, e.g. completely separate.

The present invention relates more specifically to the outlet valve 40 of the pump chamber 20, and all of the other components of the pump could be modified. The pump is therefore not described in greater detail below, since the other elements of the pump do not directly affect the present invention.

Figure 1 shows a first embodiment of the invention. In this first embodiment, the valve seat 42 includes at least one flexible deformable lip 45 that co-operates with the valve element 41 when the outlet valve 40 is in the closed position. The valve element 41 is preferably rigid and advantageously includes a frustoconical surface at its surface which co-operates with the flexible lip 45. As shown in Figure 1, when the valve 40 is in the closed position, the lip 45 is deformed, so as to improve sealing in the closed position. In a variant, it is possible to envisage two or more lips co-operating with the valve element 41. The lip 45 can be made integrally with the remainder of the valve seat 42, and in particular with the actuator rod 5 and the piston 50, in the embodiment in Figure 1. In a variant, the lip 45 could be overmolded on the valve seat 42, in which event it could be made out of a material that is softer than the remainder of the valve seat, and in particular than the

remainder of the actuator rod 5. This makes it possible to improve sealing still further, while maintaining the rigidity necessary for the other constituent elements of the pump. The outlet valve 40 is preferably urged  
5 towards its closed position by a spring 70, preferably the return spring of the pump that returns it to its rest position, and this is also valid for the embodiment shown in Figure 2. The outlet valve 40 is advantageously  
10 opened by the pressure of the fluid contained in the pump chamber 20. In a variant, the outlet valve could be urged towards its closed position by the pressure of the fluid contained in the pump chamber while the pump is being actuated. The outlet valve could then be opened at  
15 the end of the actuation stroke, e.g. mechanically. The spring 70 or the pressure of the fluid that urges the outlet valve 40 towards its closed position improves sealing still further when the outlet valve is in the closed position, and particularly while the pump is being actuated, thereby preventing any fluid from leaking, and  
20 thus preventing any dose from being lost.

In a variant to the embodiment shown in Figure 1, it is possible to envisage an inverse embodiment, i.e. in which the valve element 41 includes a deformable or flexible sealing lip that co-operates with a valve seat  
25 42 that could be frustoconical, for example.

Figure 2 shows a second embodiment of the present invention. In this second embodiment, the deformable sealing element is formed by an O-ring disposed on the valve element. The O-ring can be secured on the valve  
30 element 41 by interfitting, snap-fastening, or overmolding. The O-ring is advantageously made out of a material that is softer than the remainder of the valve element, thereby improving sealing in the closed position. As shown in Figure 2, the O-ring 46  
35 advantageously co-operates with a frustoconical surface of the valve seat 42.

In a variant to the embodiment shown in Figure 2, it is possible to envisage securing the O-ring not on the valve element 41, but on the valve seat 42, in which event the valve element would be frustoconical, as in  
5 Figure 1, and would advantageously be used to co-operate with the O-ring 46 that would be secured to the valve seat 42.

The provision of a frustoconical surface for co-operating with the deformable sealing element (lip 45 or  
10 O-ring 46) serves not only to center the valve element 41 on the valve seat 42, but also makes it possible to provide sealing during actuation, even when the force exerted by the user on the actuator rod 5 is not completely axial.

15 The pump of the present invention is designed for fastening onto a reservoir (not shown), e.g. by means of a fastener ring 60 which would be a clamping cap in the embodiment shown. Naturally, other variants can be envisaged. In addition, a dispenser head (not shown)  
20 can also be assembled on the actuator rod 5, so as to dispense the fluid coming from the pump.

Although the present invention is described above with reference to two embodiments thereof, it is clear that it is not limited by the embodiments shown. On the  
25 contrary, any useful modifications can be applied thereto by the person skilled in the art, without going beyond the ambit of the present invention, as defined by the accompanying claims.